Tyber Medical: Project Unite
Variable Angle Locking Mechanism Design

Overview: When a plating system is used for procedures, like joint fusions and fracture plating, the screws can sometimes be unscrewed by small movements of the plate. This can cause the plate to become loose, and in severe cases, the screw can cause problems within the body. In addition, surgeons can be limited by the angle of implementation.

Objectives: The challenge for this group is to design a mechanism that locks the screw to the plate so that it does not loosen itself in the body. The design must have a cone of angulation of at least +/-15 degrees, and it must be a unique and novel design. The design must be scalable plates down to 1 mm, and it must be able to be used with locking and non-locking screws.

Approach: A set of requirements, listed below, was determined through discussion with the client. These requirements were rated on a comparative chart of importance, finding a scaled value for each requirement to provide a grade. Each design considered was run through this grading system and used to choose the optimal model. Patent searches were performed to ensure that the device was unique.

- Cone of angulation of +/-15°
- Compatible with locking and non-locking screws
- Flush with upper surface of the plate
- Scalable
- Removable
- Resists pullout

Outcomes: The variable angle mechanism created is an expanding collar system, viable for both a locking and non-locking screw. Utilizing the force required to input the screw, the collar will expand in the plate and lock, with friction, with the surrounding plate. The collar is large enough to stay within the plate, but with a small enough diameter to maintain a +/-15 cone of angulation. Eventually a titanium model was ordered; however, it was never received, so mechanical testing could not be performed. A COMSOL model was made to simulate the displacement force and stresses. This showed that the device should expand without reaching a breaking stress.